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Earth resources: Threat or Treat?

Science, Society, and the Future of Earth's Resources

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(Edited remarks accompanying Dr. Myers' PowerPoint presentation)

Good morning. I'm honored and very pleased to speak to you today.

From the dawn of time, humans have regarded earth's resources as a boundless treat that, if exhausted in one area, could be found again elsewhere.

The threat to earth's resources today - from climate change and from the demands of a rapidly growing global population - has no historical parallel. The impact of humans on the planet has expanded to the extent that we live in what could be called the "Anthropocene" – a new geologic epoch in which humankind has emerged as a globally important force capable of reshaping the earth, capable of depleting or threatening many of the earth's resources.

We are now in a situation of relatively rapid climate change in which we know with certainty that we will be crossing thresholds beyond which ecosystems, and the services they provide, will be irreversibly changed. Climate change will directly and indirectly threaten the stability of natural resources and human well-being. If we do not focus on sustainable management of our earth's resources, the resource treats that we have enjoyed in the past undoubtedly will become a more and more of a threat for people in many nations.

To better understand the threat posed to earth resources by climate change and a rapidly growing global population, let's begin by looking at three familiar categories of resources: energy and minerals; water; and biological resources.

Modern society is increasingly dependent on non-renewable mineral and fossil energy resources. Economic and population growth of less developed countries functions as a relatively recent but quickly growing push factor on global demand. Still, no global shortages of non-fuel mineral resources are expected in the near future.

Despite predictions during the last 40 years that at some future time the world will run out of oil, such dire observations may be irrelevant as the production of fossil fuels from unconventional sources - such as natural gas hydrates, tar sands, coal bed methane – become economically viable.

Responsible extraction of any of the earth's natural resources – from coal to gold to gas hydrates – requires a rigorous commitment to sustainable development from economic, environmental, and socio-cultural perspectives.

As the USGS Director, I'm proud to point out that our organization continues to conduct two of the world's most respected sources of authoritative, unbiased studies of minerals and energy resources:

- USGS Global Mineral Resource Project
- USGS World Petroleum Assessment

The combination of climate change, population growth, and greater use of irrigated agriculture has resulted in increased stress on water resources around the world. Water has emerged as a global issue that requires international multi-disciplinary cooperation on assessment, research, and management. The problem is exacerbated with the expansion of population centers in water-scarce regions, such as in central Mexico, southern India, and southeast Australia.

In order to avoid situations where water becomes an increased threat rather than remaining a treat, an interdisciplinary and trans-boundary focus is required. The UNESCO International Hydrological Programme (IHP) focuses activities on water research, water resources management, education, and capacity-building with a recent shift to improving the management of water within the context of environmental sustainability. The U.S. Government and the USGS strongly support these UNESCO initiatives.

Climate change coupled with global population growth present unprecedented threats to the world's biological resources. Here are a few examples:

- Increased Desertification. Overgrazing by herd animals, wild and domestic, coupled with the overuse of soil for crops results in the removal of soil nutrients which can damage to soil surface structure.
- Increased Floods. Floods resulting from changed rainfall patterns will impact fisheries and aquatic systems, their productivity and diversity.
- Increased Storm Intensity. An increased trend in sea-surface temperature during the 20th century has been more pronounced in the past 35 years. Increased sea-surface temperatures have implications for producing hurricanes with greater intensity and increased coastal vulnerability in the future.
- Loss of Biodiversity. Changes in climate influence the size of plant and animal populations, which in turn affects the distribution and abundance of species, and ultimately ecosystem structure and function.

- Loss of Reef Building Corals. The destruction of coral reef ecosystems would expose coastal populations to flooding, coastal erosion, and the loss of food and income from reef-based fisheries and tourism.

At this point you may be thinking ahead to what further categories of threatened earth resources I might present before I come to a welcome conclusion. We're not quite there yet.

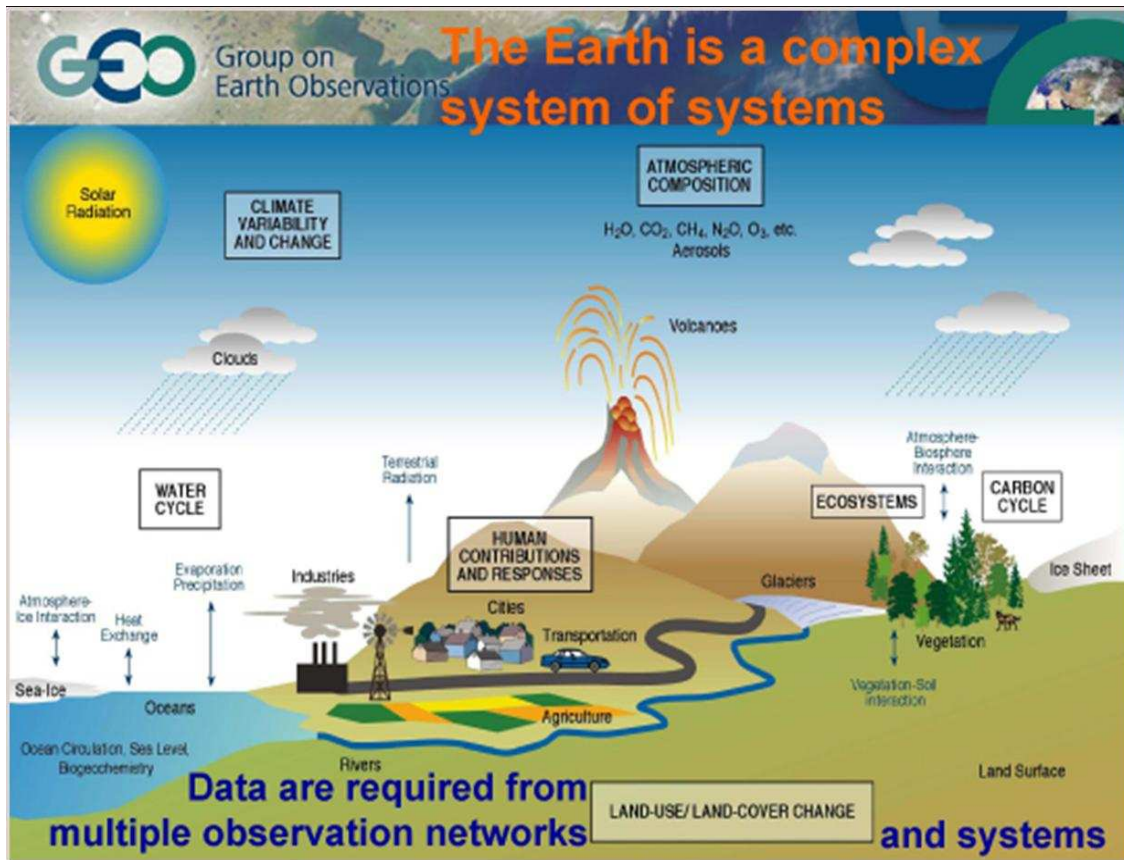
"Ecosystem" is the term for an integrated system of organisms interacting with their physical environment. Resilient, functioning ecosystems:

- build fertile soil
- enhance pollination of crops
- purify water
- regulate the atmosphere
- detoxify waste.

These types of earth resources are not so easily categorized into conventional categories or analyzed by traditional science disciplines. The essential point that I want to make today, a perspective that I support very strongly, is that all of earth's resources are interrelated.

In this first decade of the 21st Century, we face many threats to earth resources that have sustained us in the past: threats on a global scale such as climate change, drought, natural disasters, deforestation, competition for energy and mineral resources. Additionally, there are important human health impacts that are tied to the quality of our air and our water. These problems cannot be solved by individuals – or groups of nations. We are all at risk. And we must act together to mitigate and adapt to that risk.

At USGS, we've developed a science strategy that we believe will help our organization – and our country – address complex environmental problems. Our strategy is based on a systems approach to evaluate broad causes and consequences of the use and management of natural resources and earth processes.



In this slide supplied by GEO (Group on Earth Observation), we see a rough illustration that hints at the complexity and the interrelated quality of Earth's natural systems coupled with interactions of human activity. There are six interrelated thematic components - directions - in our science strategy that you see listed in this slide. The interaction, correlation, and interplay of these directions both reflect and reveal the complexity of the Earth's natural, physical, and life systems. They describe the breadth of our systems approach that calls upon the full range of USGS science capabilities. This comprehensive, interdisciplinary approach pays dividends in making our science more relevant to environmental issues in public policy.

Because climate affects all life on earth, the expanded USGS climate studies are closely linked to ecosystem, health, water, hazards, and energy issues. The USGS energy and minerals strategy will be enhanced and broadened to deal not only with resource availability, but also with a broad spectrum of related land, water, and environmental concerns.

At USGS we believe that the starting point to understanding the complexity of earth systems is the concept of ecosystems. Ecosystems constitute the Earth's biosphere and support human existence. The plants, animals, microbes, and physical products from ecosystems provide people, as components of those ecosystems, with the energy, water, biomass, medicine, and mineral resources needed to sustain human societies.

Understanding ecosystems and predicting ecosystem change requires robust scientific assessments and modeling of ecosystem conditions as climate and human-induced land changes occur.

Ecosystems are inherently “interdisciplinary,” with geographical, biological, geological, hydrological, and other components. Ecosystems are also inherently “multiscalar,” spatially and temporally. They are usually recognized and managed at site-specific (local) scales, but are also described at broader scales from regional to global.

USGS scientists are mapping ecosystems by integrating their “structural” components, e.g., landforms, climate, geology, land cover, etc. Geographically standardized ecosystem inventories – as maps or databases – enable scientists to pursue conservation planning and resource management. As a case study of our systems approach, the interdisciplinary work of USGS scientists provides sound scientific data to facilitate efforts to restore the Everglades to its original functions.

The Everglades ecosystems have been designated by UNESCO as a World Heritage Site and as part of the World Network of Biosphere Reserves. The habitat in south Florida originally supported far-ranging animals, like the Florida panther, and super-colonies of wading birds, such as herons, egrets, roseate spoonbills, ibis, and wood storks.

Human alterations to the Everglades ecosystem during the 20th century (exponential population growth, drainage changes, agricultural practices, urbanization) have resulted in severe ecosystem degradation as evidenced by:

- 90% decline in wading bird populations
- declines in commercial, recreational fisheries
- widespread invasions of exotic plants and animals (e.g., the melaleuca tree, water hyacinth, walking catfish, and Burmese python)

The USGS has many ongoing research projects that are expanding scientific knowledge of unique Everglades ecosystems.

The USGS plays a key role in many international efforts to develop a global understanding of earth systems, such as:

- Global Seismic Network
- International Polar Year
- International Council for Science
- UNESCO International Hydrological Programme (IHP)
- Global Earth Observation System of Systems (GEOSS)
- A Satellite Image Atlas of Endangered World Heritage Sites (UNESCO)
- Famine Early Warning System Network (FEWS NET, U.S.)

The USGS supports the Famine Early Warning System Network (FEWS NET). The objective of this U.S. Government program is to improve food security in 22 drought-prone African countries. The animated series of NDVI images shows seasonal

development of vegetation across the continent for one year. An advantage of remotely sensed data is its ability to frequently monitor large areas; however, it is crucial that these data are coupled with field observations and other ground-based measurements to address localized food security issues.

U.S. Water Resources Conference in support of UNESCO's IHP

A one-day workshop led by NSF and USGS in support of UNESCO's IHP will take place on June 27, 2008, in Washington, DC, at the U.S. Department of State. The purpose of the conference is to explore how to accelerate application of U.S. technology and knowledge to solve water resources and water quality management problems in developing countries. The participants will be high level representatives from U.S. agencies with interests and responsibilities for water, Director General of UNESCO, Ambassador Louise Oliver, leading U.S. scientists; 30 to 50 people.

Expected outcomes are:

1. Recommendations for greater infusion of US science and technology into addressing water issues in developing countries.
2. Direct input into an upcoming international conference involving several hundred people that will be sponsored by the US Committee on Hydrology (with UNESCO) on "Water Scarcity, Global Change, and Groundwater Management Responses" and to be held December 1-8, 2008 in Irvine, CA

Two major topics for the June meeting will be integrated water resource management in semi-arid and arid regions, and meeting needs for potable water and sanitation in the rapidly expanding urban environments of developing countries.

Today I've explained how the USGS has developed what we believe is a versatile, powerful approach - a science strategy based on systems analysis - to grasp the environmental issue of our time, global climate change and its implications for earth's systems. As I mentioned earlier, these problems cannot be solved by individuals - or groups of nations. We are all at risk. And we must act together to mitigate and adapt to that risk.

We need a better knowledge base - a comprehensive scientific, engineering, economic framework - from which we can build social and economic policies that lead to greater energy and resource sustainability at national and international levels.

With its broad global partnerships and clearly stated goals for societal benefits, GEOSS, in particular, is an excellent example of a collaborative mechanism with which to build a widely accessible international knowledge base. However, we must do much more on many scientific fronts.

Inevitably world leaders will be obliged to make decisions in the next few years - whether in boldness or in inaction - that will influence the future health of our planet.

These world leaders - who speak for all of us - must have a more confident understanding of the science of the natural world if we, as societies, are to act wisely and implement sound policies that promote sustainable development and prosperity for our people.
